



## Using Graduated Sequence of Instruction to Teach Algebraic Integer Subtraction

**Objective:** To teach students to represent and solve algebraic word problems that involve the subtraction of integers.

### Setting and Materials:

**Settings:** Conference room, resource room

**Materials:** Algebra Lab Gear (Picciotto, 1990)

### Content Taught

The primary content taught came from STAR (Maccini, 1998), which includes lessons on positive and negative numbers, subtraction of integers, and solving word problems involving integer subtraction. STAR is an acronym for **S**earch the word problem, **T**ranslate the words into an equation in picture form, **A**nswer the problem, and **R**evue the solution. It is taught in the following phases: pretest, concrete, semi-concrete (i.e., representational), and abstract.

The concrete phase consists of instruction in the first two steps of STAR are taught. First, students are taught to “**S**earch the word problem” by: (a) reading the problem carefully, (b) asking themselves “What facts do I know?” and “What do I need to find?”; and (c) documenting important facts. Second, students “**T**ranslate the words into an equation” by choosing a variable, identifying the operation(s), and representing the picture using concrete manipulatives (i.e., algebra tiles). Upon accurately representing the problem for 80% of opportunities or more on two consecutive applications, students progress to the semi-concrete phase.

During the semi-concrete phase, the same two steps are implemented. However, students no longer have access to the algebra tiles. Instead, students are taught to translate the words into an equation by drawing representations of the tiles. The mastery criterion is the same, representing the problem with 80% accuracy or greater for two consecutive probes.

In the final phase, abstract, students apply the entire strategy. During this phase students “**A**nswer the problem” using a process for solving problems with integers and a rule for adding and subtracting integers. The addition of integers rule was: (a) if the signs are the same, add the numbers and keep the sign; and (b) if the signs are different, find the difference of the numbers and keep the sign of the number farthest from zero.

The subtraction of integers rule was to add the opposite of the second term. After answering the problem, students are taught to “**R**eview the solution” by rereading the problem, asking if the answer makes sense and why, and checking the answer.

### Teaching Procedures

Lessons consisted of the following six steps (1) delivering an advance organizer, (2) modeling the new skill, (3) guided practice, (4) independent practice, (5) posttest, and (6) feedback/rewards. Each step is described below.

1. *Advance organizer.* During this step the teacher should (a) connect the material to be learned with previous lessons, (b) explicitly identify the new skill or concept, and (c) provide a rationale for learning the new skill or concept.
2. *Model.* Modeling is done in two ways. First the teacher should complete a problem using the new skill while “thinking aloud” for the students to hear. Next, the teacher should include the students in solving three problems with the think aloud process as a group.
3. *Guided practice.* Students apply the targeted steps in the STAR to three practice problems with the teacher supervising closely.
4. *Independent practice.* Students complete five problems independently and the teacher checks for understanding.
5. *Posttest.* A final test is presented that students need to complete the targeted steps (i.e., for concrete and semi-concrete students need to represent the problem, with abstract students need to represent and solve the problem) with 80% accuracy or better to progress to the next phase. If students do not meet the 80% criterion, additional modeling and/or guided practice should be delivered as needed.
6. *Feedback/Rewards.* Corrective feedback entailed five steps. First, the teacher and student document performance by calculating the accuracy. They then identify incorrect responses and error patterns. Next the teacher should reteach any errors through modeling. Fourth, the student should practice the correction with similar problems. Last, the teacher should end the feedback session by providing positive feedback. Rewards can be given intermittently throughout the teaching process for on-task behavior.

### Evaluation

*Percent correct for problem representation.* Problem representation was scored on a five-point scale. Students were given 5 points for correctly representing the problem, 2.5 points for partially correct representation, 1 point for attempting to represent the problem, and 0 points for no attempt.

*Percent correct for problem solution.* Problem solution was scored on a five-point scale. Students were given 5 points for correctly solving the problem, 2.5 points for a partially correct solution, 1 point for attempting to solve the problem, and 0 points for no attempt.

**Lesson Plan Based on:**

Maccini, P., & Ruhl, K. L. (2000). Effects of a graduated instructional sequence on the algebraic subtraction of integers by secondary students with learning disabilities. *Education and Treatment of Children*, 23, 465-489.

This Lesson Plan Starter was developed by The National Technical Assistance Center on Transition (NTACT), Charlotte, NC, funded by Cooperative Agreement Number H326E140004 with the U.S. Department of Education, Office of Special Education and Rehabilitative Services (OSERS). This document has been reviewed and approved by the OSERS. Opinions expressed herein do not necessarily reflect the position or policy of the U.S. Department of Education nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Department of Education. OSEP Project Officer: Dr. Selete Avoke. RSA Project Officer: Kristen Rhinehart-Fernandez. This product is public domain. Authorization to reproduce it in whole or in part is granted. While permission to reprint this publication is not necessary, the citation should be: National Technical Assistance Center on Transition (2018). *Using Graduated Sequence of Instruction to Teach Algebraic Integer Subtraction*.

